

The Effect of Acupuncture on the Success of Inferior Alveolar Nerve Block for Teeth with Symptomatic Irreversible Pulpitis: A Triple-blind Randomized Clinical Trial

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Abstract

Introduction: An inferior alveolar nerve block (IANB) does not always provide satisfactory anesthesia for patients with irreversible pulpitis. The aim of this study was to assess the effect of preoperative acupuncture on the success rate of IANBs for teeth with symptomatic irreversible pulpitis. **Methods:** In a randomized triple-blinded clinical trial, 40 patients with symptomatic irreversible pulpitis were divided into 2 groups: the acupuncture and control groups. In the acupuncture group, a disposable needle was inserted at LI4 (Hegu) acupoint, and after 15 minutes, for patients who had reported the De qi sensation, an IANB was administered. In the control group, 15 minutes before the administration of an IANB, the practitioner simply imitated the acupuncture procedure but did not actually insert the needle. Endodontic treatments were conducted for the patients who reported lip numbness 15 minutes after the injection of the IANB. If the patients felt intolerable pain (>20 mm on a visual analog scale of 100 mm) during the procedure, a supplementary injection was administered. In those situations, the IANB was considered an unsuccessful injection. Data were evaluated by the chi-square, Wilcoxon, Mann-Whitney, and *t* tests. The level of significance was set at 0.05. **Results:** The overall success rates of IANB for the acupuncture and control groups were 60% and 20%, respectively ($P < .05$). **Conclusions:** The application of acupuncture before the endodontic treatment increased the effectiveness of IANBs for mandibular molars with symptomatic irreversible pulpitis. (*J Endod* 2015;41:1397–1402)

Key Words

Acupuncture, anesthesia, inferior alveolar nerve block, symptomatic irreversible pulpitis

Pain control during an endodontic procedure is 1 of the most challenging goals for dentists because in comparison with teeth with normal healthy pulps, obtaining complete anesthesia, particularly in mandibular posterior teeth with irreversible pulpitis, is much more difficult (1, 2). To anesthetize the mandibular posterior teeth, an inferior alveolar nerve block (IANB) (3) is usually applied, but this technique does not always provide satisfactory anesthesia for patients with irreversible pulpitis (4, 5).

Several studies have evaluated various possible solutions to increase the effectiveness of IANBs during endodontic treatment (6–9) such as premedication with nonsteroidal anti-inflammatory drugs (NSAIDs) (10–12) and steroidal anti-inflammatory drugs (13–15), but they have reported conflicting results.

Acupuncture is 1 of the alternative therapeutic procedures (16); it has been recognized as an effective technique to control pain in dentistry, including facial pain, dental pain, and postoperative pain (17, 18). Although no scientific literature was found on the use of acupuncture to increase the success of an IANB for teeth with irreversible pulpitis, according to a systematic literature review (19), acupuncture can be effective in relieving dental pain, either during surgical procedures or after surgery.

During acupuncture, thin needles are inserted in some points on the surface of the body known as acupuncture points or acupoints. LI4 Hegu is 1 of these points, which has been widely used to control dental pain (20, 21) and masticatory muscle pain (22). If a needle is accurately inserted into the acupuncture point, the patient will feel a specific sensation called *De qi*, which can present as numbness, heaviness, or distention around the area of insertion. It is a desired and necessary effect for acupuncture to be effective (23, 24). Although the acupuncture's mechanism of action has not yet been exactly established, according to the literature (25), insertion of the needles into the acupuncture points leads to release of enkephalin, which is a blocker of substance P, a neurotransmitter that stimulates pain. Therefore, acupuncture inhibits the pain sensation. Rosted (25) reported that the stimuli of acupuncture cause the release of serotonin, which is responsible for increased levels of endorphin and ACTH (adrenocortical hormone). ACTH increments lead to an increase in the release of cortisol, which helps patients control their stress and anxiety.

Acupuncture is a natural and low-cost procedure; it is also safe if performed by a professional with proper training (26). Considering the fact that anti-inflammatory medications have some adverse effects such as gastrointestinal ulcers, allergic reactions, and so on (27), acupuncture can be used as a safer supplemental technique to control pain in dentistry (17, 18). Therefore, the aim of the present study was to

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assess the effect of preoperative acupuncture on the success rate of IANBs for teeth with symptomatic irreversible pulpitis.

Materials and Methods

This parallel randomized clinical study was approved by the Ethics Committees of Qazvin University of Medical Sciences (no. 8739/20/28 and Iranian Registry of Clinical Trials no. IRCT2013121615814N1). Sample size determination was based on a medium effect size of 0.5, α error of 0.05, and power at 0.8. It was determined by using PASS software version 6.0 (NCSS, Kaysville, UT). In doing so, it was determined that up to 20 patients are required in each group.

Participants who met the following criteria were excluded from the study: the presence of systemic or mental disorders, sensitivity to lidocaine with 1:80,000 epinephrine, presence of periapical radiolucency or even a widening of the periodontal ligament space, severe periodontal disease, pregnancy, lactation, a history of treatment with acupuncture, using any type of medication that could affect the perception of pain such as tricyclic antidepressants and selective serotonin reuptake inhibitors, taking any analgesic drugs in the preceding 6 hours before the endodontic therapy, or using any type of corticosteroid medications.

Patients were included in this study if they had a restorable first or second mandibular molar with symptomatic irreversible pulpitis and a history of spontaneous pain (pretreatment pain >66 mm on a visual analog scale [VAS] of 100 mm). These teeth were evaluated via an electric pulp test using the Element Diagnostic Unit (SybronEndo, Glendora, CA) and a cold test (Roeko Endo-Frost; Roeko, Langenau, Germany). A clinical diagnosis of symptomatic irreversible pulpitis was confirmed with a response to the electric pulp test and a prolonged intense response (10 seconds or more) with severe pain (>66 mm on VAS of 100 mm). All clinical evaluations were performed from October 2013 to June 2014 by an endodontist in the clinic of the Endodontic Department of Qazvin Dental School in Iran. The nature of the procedures and the possible discomforts and risks had been fully explained to all participants, and informed written consent was obtained.

Forty patients were eligible to participate in this study and were randomly divided into 2 groups: the acupuncture group ($n = 20$) and the control group ($n = 20$). To randomize the patients, 40 papers were numbered 1 to 40, and the first 20 papers were placed individually in a red sealed envelope; the remaining 20 were placed individually in a blue sealed envelope. Each female participant was instructed to select a

red sealed envelope, and each male participant was asked to select a blue one. Upon opening the envelopes, based on the number (odd numbers for the acupuncture group and even numbers for the control group), they were assigned to 1 of the 2 corresponding groups. This ensured an equal number of male and female participants per group. To maintain the triple-blind design, a professional acupuncturist applied acupuncture, and a second investigator who was an endodontist performed the endodontic procedure. At the end of the investigation, all findings were coded before conducting statistical analysis.

In the acupuncture experimental group, the acupuncture point was selected based on Traditional Chinese Medicine (28); therefore, LI4 (Hegu) was selected to control dental-facial pain (28). Hegu is located on the back of the hand; it is between the first and second metacarpal bones, at the midpoint of the second metacarpal bone, close to its radial border. To identify the point, the practitioner asked the patient to adduct the thumb and the index finger; Hegu is located at the highest point of the first and second metacarpal muscles (29). A disposable acupuncture needle (length 25 mm, diameter 0.25 mm; Suzhou Huanqiu Acupuncture Medical Appliance Co Ltd, Suzhou, Jiangsu, China) was inserted 1–1.5 mm deep at Hegu on the side of the subjected tooth. For example, for a patient with symptomatic irreversible pulpitis in tooth #30, the needle was inserted at Hegu on the right hand. To simulate the experimental group experience, a cotton pellet and Band-Aid (Johnson & Johnson, São Paulo, SP, Brazil) were placed around the needle used for the control group patients (Fig. 1). As described previously, when the needle is accurately inserted into the acupuncture point, the patient will feel a specific sensation called *De qi*. *De qi* is a necessary effect for acupuncture to be effective (23, 24), and the patients who did not report it were excluded from the study.

After 15 minutes, another practitioner who was an endodontist administered IANB injection. The endodontist was not aware whether or not the patient had had real acupuncture.

To administer the injections, self-aspirating syringes (Septodont, Saint-Maur-des-Fosses Cedex, France) and 27-G 38-mm needles (Carpule; Heraeus Kulzer GmbH, Hanau, Germany) were used. In all cases, the injection was performed using a cartridge of lidocaine (2% lidocaine with 1/80000 epinephrine; Darupakhsh, Tehran, Iran) based on a standard IANB method (30). A blood aspiration test was performed for all patients before the injection of an anesthetic solution. Fifteen minutes after the injection, the patients who did not report profound lip numbness were excluded from the study because this was considered a failed IANB. For those

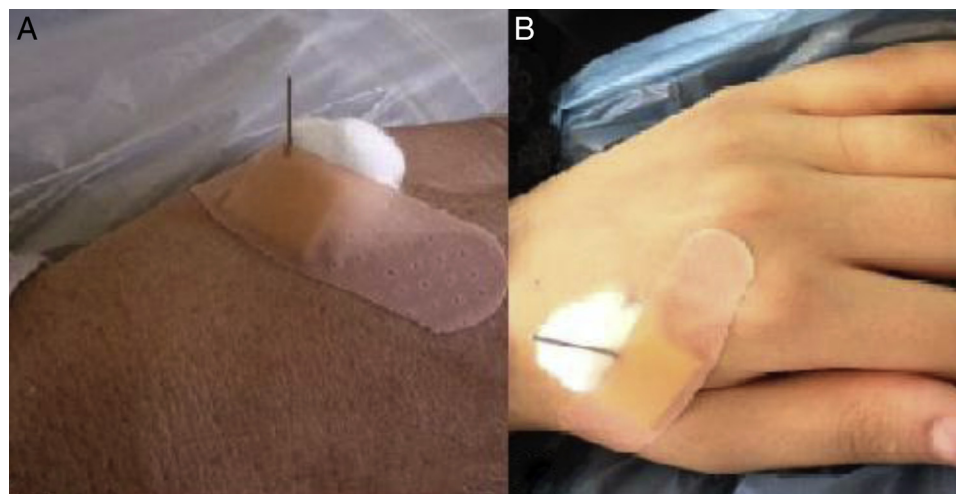


Figure 1. The position of the needle for patients in the (A) acupuncture and (B) control groups was similar in appearance.

patients who reported successful lip numbness, the subjected tooth was isolated with a rubber dam, and endodontic access cavity preparation ensued. The patients were instructed to report any pain experienced during access cavity preparation. Whenever a patient reported intolerable pain (>20 mm on VAS of 100 mm), a supplementary injection was performed and that IANB was considered an unsuccessful injection. On the other hand, if the access cavity preparation was completed without any indication of pain, the IANB was considered a success. At the end of the pulpotomy, a cotton pellet

was placed into the pulp chamber, and the access cavity was sealed using Cavit (coltosol; AriaDent, Tehran, Iran); then, the acupuncture's needle was removed, and the patient was monitored for 48 hours after the procedure.

In the control group, the practitioner mimicked the application of acupuncture; a sham needle with a noncutting end was placed at a point 1.0 cm from LI4 (the needle did not penetrate into the skin), and the needle was fixed using a cotton pellet and a Band-Aid (Fig. 1). All procedures were performed out of the patient's field of vision. In both

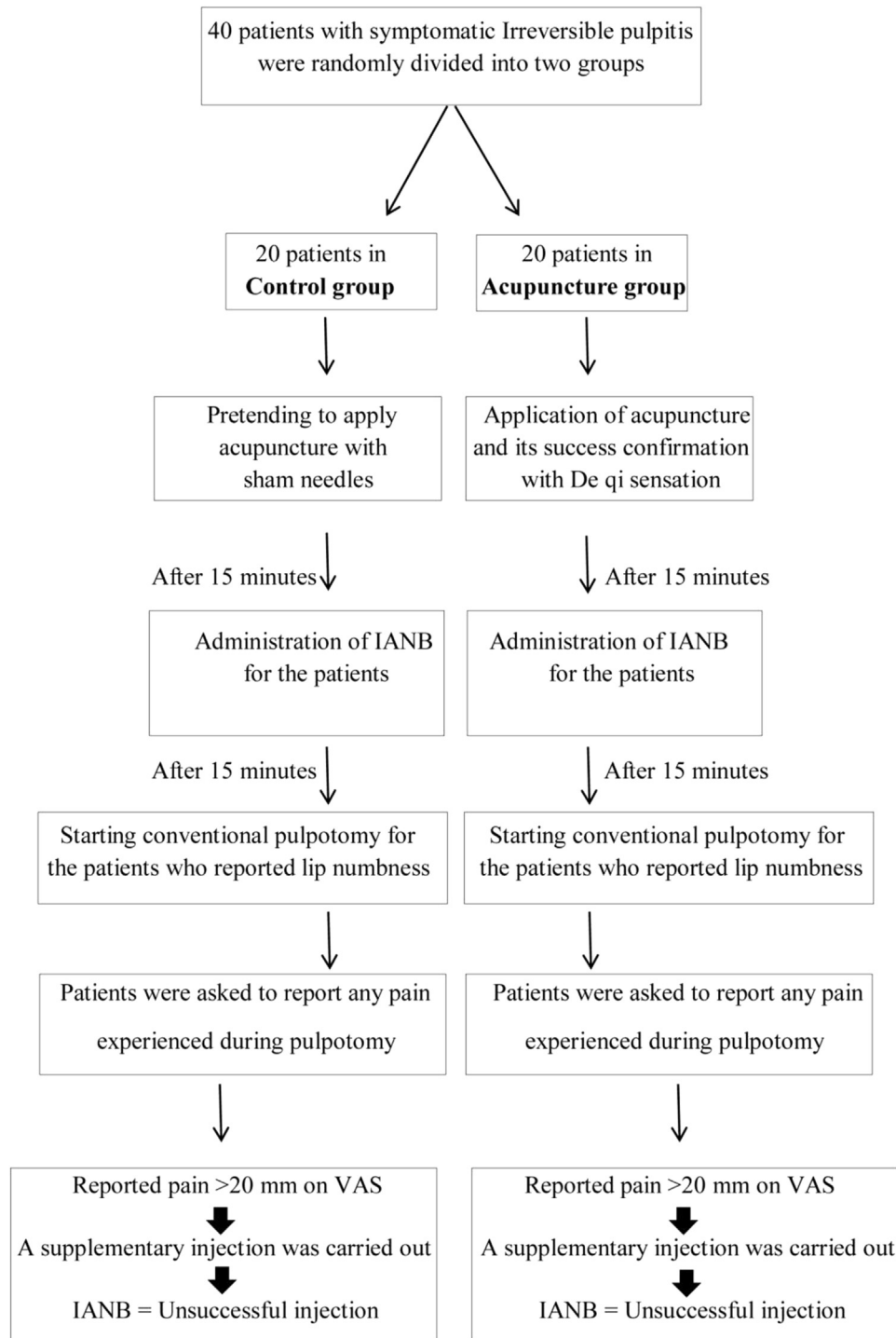


Figure 2. The summarized procedure for the patients in the acupuncture and control groups.

groups, a 15-minute waiting interval was allowed after acupuncture (or mimicked acupuncture) application. After 15 minutes, an endodontist administered an IANB, and again, 15 minutes were allowed for profound lip numbness to occur. For patients who reported profound lip numbness, a conventional pulpotomy procedure was conducted (Fig. 2).

The analysis of data was performed using SPSS software (SPSS 21; SPSS Inc, Chicago, IL). The findings were coded to maintain a blind data analysis. Data were evaluated by the chi-square, Wilcoxon, Mann-Whitney, and *t* tests. The level of significance was set at 0.05.

Results

This study included 40 patients (20 men and 20 women) who ranged in age between 18 and 53 years (mean = 29.1 ± 8.44 years). No significant differences were found regarding the age of the patients in the 2 groups. Baseline characteristics of the groups are presented in Table 1.

All participants reported lip numbness within 15 minutes after the injection. In addition, all patients in the acupuncture-treated group reported De qi sensation after the needle insertion, and no patient reported any side effect for up to 48 hours after the procedures. Therefore, no patient was excluded after randomization.

There were no significant differences between the severity of patients' pretreatment pain among the 2 groups. In addition, no significant relationship was found between the severity of pretreatment pain and unsuccessful IANBs in the 2 groups.

The overall success rates for the acupuncture and control groups were 60% and 20%, respectively (Table 2). Therefore, the success rates of IANBs for the patients in the acupuncture group were significantly higher than those in the control group ($P < .05$). The severity of the reported pain by the patients during the procedure has also been shown in Table 2. Although the success rates of IANBs for the female patients in both groups were lower than those of male participants, the differences were not significant.

Discussion

The results of this study have shown that acupuncture administered 15 minutes before endodontic treatment significantly increases the success rate of IANBs for mandibular molar teeth with symptomatic irreversible pulpitis. Demographic characteristics of the participants of our study such as age, sex, and pretreatment pain were not significantly different between the groups. Therefore, these factors had no effect on the findings.

In the present study, the success rate of IANBs for anesthetizing the mandibular molar teeth with irreversible pulpitis in the control group was found to be 20%. A range of 12.7%–32% for successful IANBs has been reported by previous studies (3, 13, 31), which confirms that in most cases IANBs cannot completely and successfully anesthetize teeth with irreversible pulpitis.

Our findings showed no significant relationship between the severity of pretreatment pain and unsuccessful IANBs in the 2 groups.

TABLE 1. The Baseline Characteristics of the 2 Groups

Characteristics	Acupuncture group (<i>n</i> = 20)	Control group (<i>n</i> = 20)
Age (years)	29.3 ± 8.81	28.9 ± 8.28
Sex (M/F)	10/10	10/10
Pretreatment pain (VAS of 100 mm)	85.8 ± 13.65	89.1 ± 12.3

F, female; M, male; VAS, visual analog scale.

TABLE 2. The Success Rates of Inferior Alveolar Nerve Blocks and Severity of Pain during the Endodontic Procedure

Groups	Successful injection, <i>n</i> (%)	Severity of pain during procedure (VAS)
Acupuncture	12 (60)	23.95 ± 29.05
Control	4 (20)	51.1 ± 29.53

VAS, visual analog scale.

This was because of the fact that all selected participants had severe pretreatment pain (>66 VAS of 100 mm).

Although the effects of several medicaments on the success rate of IANBs for anesthetizing the mandibular molar teeth with irreversible pulpitis have been evaluated in numerous studies (3, 10–13, 32–34), their findings were conflicting. For example, some researchers have shown that premedication with NSAIDs is an effective way to overcome pain during dental procedures (3, 35), whereas other researchers found no significant differences in IANB success rates when the patients were premedicated with analgesics (10, 11). In addition, Li et al (33) in a systematic review showed that a dosage of 75 mg indomethacin had a significant effect compared with placebo as did 8 mg lornoxicam and 50 mg diclofenac potassium but other NSAIDs such as ketorolac, ibuprofen, and acetaminophen together and acetaminophen alone showed no statistical significance compared with placebo.

Acupuncture has been practiced in Asian countries, particularly China, to control pain for more than 4000 years. Today, acupuncture is gaining popularity as an alternative procedure to control pain (36). According to the literature, pain thresholds are elevated after acupuncture; it is also suggested that acupuncture affects mechanical pain induced by punctate objects, which is primarily mediated by A δ nerve fibers (36). In addition, it has been shown that the transmission of cold and heat pain, which are mainly evoked by C- and A δ nerve fibers, is affected by acupuncture in healthy subjects (36). Previous studies have also shown that acupuncture is effective in the treatment of acute (37–39) and chronic pain (40).

Several mechanisms have been suggested to explain the effect of acupuncture. As described previously, acupuncture may cause the release of some mediators, which can inhibit substance P (a neurotransmitter that stimulates pain) and increase the release of cortisol, which helps the patients control their stress and anxiety (25). In addition, brain imaging studies have revealed that acupuncture varies the activation patterns in the pain processing areas of the brain (41). It is assumed that the needle stimulation causes the endogenous pain modulation's mechanisms to reduce pain perception; these mechanisms are diffuse noxious inhibitory controls, segmental inhibition, and descending pain control pathways (42, 43). Previous studies have identified several centrally and/or peripherally acting neuromodulators and neurotransmitters such as endorphins (44), adenosine triphosphate (45), and serotonin (46) that play an important role in the analgesic effect of acupuncture.

To summarize, it is assumed that a modulation of the nervous system forms a central part of the effect of acupuncture, but details are unclear (36). In addition to the previously mentioned evidence, acupuncture has been approved as a treatment for dental pain in 1997 and 2000 by the National Institutes of Health and British Medical Association (47, 48). Therefore, in the present study, acupuncture was chosen as a nonpharmacologic option to increase the patient's threshold of pain before an endodontic procedure.

We used the LI4 (Hegu) acupoint in this study. This point is not only an important point of analgesia in Chinese medicine (28) but also is frequently used to control dental-facial pain (20, 21, 49, 50).

Furthermore, its location on the hand does not interfere in the dental procedure. In this study, the participants were administered acupuncture treatment on the side of their subjected tooth because of reports that ipsilateral acupuncture injection sites exhibit stronger effects on sensory thresholds than needle insertion at contralateral sites (36).

Although no previous study evaluating the effect of acupuncture on the success of IANBs was found, there is a growing body of evidence indicating that acupuncture is effective in controlling dental-facial and masticatory muscle pain (17–22, 49, 50).

Acupuncture is a nonpharmacologic technique and does not have the side effects associated with conventional pain; however, there are some literature reports of adverse reactions such as sweating, dizziness, drowsiness, and bleeding in 7%–11% of the patients treated with acupuncture (51). In the present study, no patient displayed adverse reactions during treatment, and no one reported any side effects for up to 48 hours after the procedure.

It is not apparent how long it takes to observe optimal effects on acupuncture on dental pain; therefore, further studies are necessary to investigate optimal time for the application of acupuncture before the endodontic procedure and its effects on postendodontic pain.

Conclusion

According to the results of this study, the application of acupuncture before endodontic treatment increased the effectiveness of IANBs for mandibular molars with symptomatic irreversible pulpitis.

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The authors deny any conflicts of interest related to this study.

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